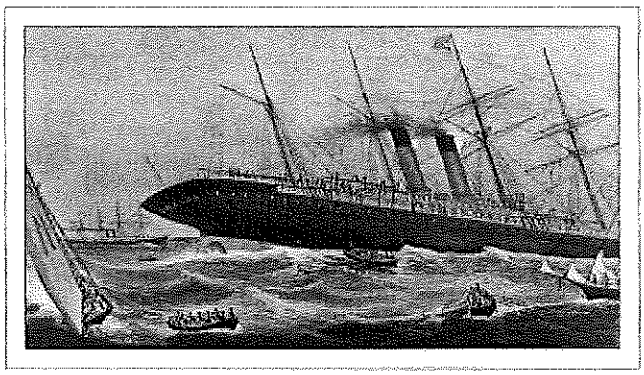
Deep-Sea Diving A Century Ago



It was treacherous hard work, depending on technology that was barely good enough to make it possible

BY KENNETH D. ACKERMAN

Left: Nearby boats hurry to the rescue of the stricken *Oregon* in an 1886 Currier & Ives print. Right: Diving gear of the type worn by Bill Dwyer, with copper helmet, rubberized canvas suit, lead weights, and lead-soled boots.

THE STEAM TUG ROLLED GENTLY ON THE NORTH Atlantic swells. It was a chilly April morning in 1886. Bill Dwyer sat on deck and donned the modern deep-sea-diving dress of his day: copper helmet connected by a rubber air hose to a hand-cranked pump; brass-and-rubber suit sealed to the helmet and garnished with lead weights hung over the back and chest; and heavy lead-weighted boots to let him walk, not swim, on the sea floor—more than 150 pounds of gear in all, not counting the many fathoms of hose and rope.

Weeks earlier the 520-foot luxury Cunard steamer *Oregon* had collided with a schooner and sunk in 130 feet of water 20 miles south of Fire Island, off the south shore of Long Island, New York. Miraculously, none of the 845 passengers and crew perished in the disaster; all were rescued by a passing German steamer. Now a team of divers had come to try to rescue the cargo.

Even today the deep-water salvage of an offshore wreck can be difficult. A century ago it was mind-boggling. Yet divers like Bill Dwyer were performing these remarkable exploits almost routinely by the mid-1880s. Dwyer's experiences that day on the *Oregon* dramatize the dangers that these undersea pioneers faced.

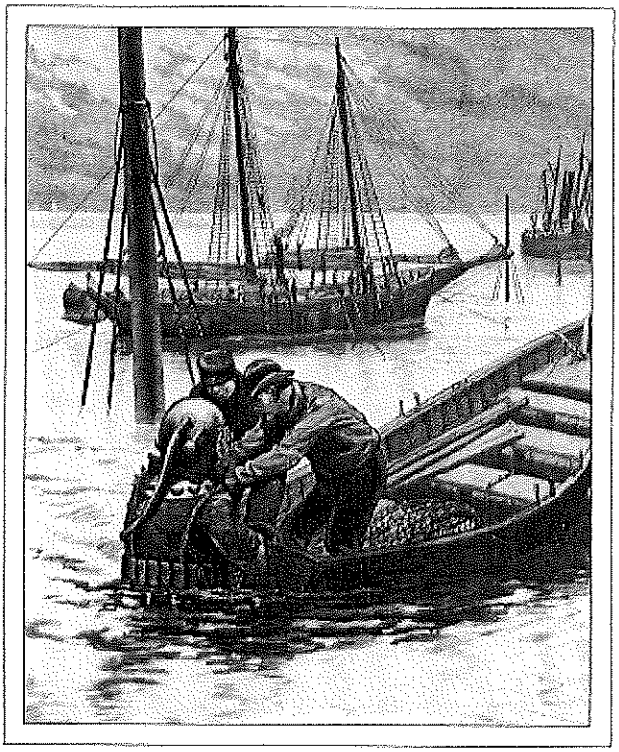
Modern "scuba" (an acronym for "self-contained underwater breathing apparatus") dates to the 1940s, but reliable helmeted, surface-connected diving began in 1819, when Augustus Siebe, a German-born British inventor, patented the first system to supply a diver with a continuous flow of air from a pump on the surface. Siebe borrowed his idea from diving bells, the undersea marvels of the seventeenth and eighteenth centuries. Since the 1780s divers had known how to supply these bells, which were submerged open end down to trap air inside and were large enough for a passenger or two, with fresh air from a hand-cranked pump on the surface via a hose.

Siebe replaced the bell with a helmet around the diver's head. In his first version, the helmet was open at the bottom, with air pressure keeping the water out. An improved version used a helmet sealed to a suit with vents at the waist to let excess air escape (the "open" suit). Finally, in 1837, Siebe produced a suit with a valve on the helmet that a diver could open or close to control the air pressure inside (the "closed" suit). Siebe proved what his invention could do between 1834 and 1837 by repeatedly sending his partner, Charles Deane, sixty-five feet down to the bottom of England's Spithead Harbor in an open suit. Deane was able to recover about thirty cannon from the wreck of the *Royal George*, which had sunk fifty years earlier. Soon the British Admiralty gave divers a featured role in its salvage operations; wearing closed suits, they were able to dynamite what was left of the *Royal George*'s wreck.

And soon the demand for divers' services went far beyond the military. Britain lived by its shipping, and the

maritime industry needed better ways to recover lost cargoes, repair damaged hulls, and investigate insurance claims. Builders needed better ways to lay underwater foundations for bridges, tunnels, and seawalls. Within a few years, scores of divers in Britain and around the world were making a living at this new trade. Diving salvage shops soon dotted the waterfront alleys around American ports like Key West, Boston, and New York.

Siebe's system was already much improved by Bill Dwyer's time, but diving in the 1880s was still a far cry from diving today. The men who donned "diving armor" and flung life and limb beneath the waves with primitive technology and limited science required a rare breed of courage, smarts, composure, and physical strength. Bill Dwyer was one of perhaps five dozen professional salvage divers in America in 1886 and a ten-year veteran in the trade.



A contemporary engraving shows a diver, possibly Dwyer himself, and his assistants during salvage operations on the *Oregon*.

When Dwyer was ready to enter the water on that April morning, he told his "tender," or assistant, to screw the thick glass plate over his face, making his diving helmet airtight. From then on Dwyer could breathe only pumped air. As he lowered himself down a metal ladder from the boat, he heard the "pah . . . pah . . . pah" of the pump and felt gentle puffs of cool, machine-oil-smelling air by his nose. A second helmet opening puffed air by his ears.

Nineteenth-century diving was a team effort. A diver below needed at least three topside mates: two to crank the air pump and a tender to handle his air hose and lifeline (a simple rope attached to the diver's waist). Divers used these lines to communicate from below with agreed-upon signals. A tug on the air hose could mean "more air"; a tug on the lifeline could mean "O.K." or "bring me up."

Upon hitting the cold water, Dwyer must have shivered. His diving suit had thin rubber gloves better suited for the Caribbean than the North Atlantic. Under the suit he wore leggings, wools, and the emblematic red diver's hat pulled down over his ears.

Though his diving suit made him bulky on the surface, Dwyer felt graceful once submerged. He descended slowly through the layers of green ocean as his tender let out the hose and line carefully. Dwyer found his way down to the *Oregon* by following a line hooked into the wreck, now known as the down line. Along the way he controlled his buoyancy by adjusting an exhaust valve in his helmet. By closing the valve, he collected air inside the helmet and suit, adding buoyancy—as with a modern dry suit. A gurgling sound echoed in his helmet with each adjustment.

The gear of the 1880s had its tricky features, and a 130-foot dive had special dangers. In rough seas the rocking ship could pull the lifeline up and down. If the diver in his bulky gear lost hold of the down line, the lifeline could yank him like a yo-yo or swing him like a pendulum. If he leaned too far sideways, air could rush up his legs, turning him upside down—a dangerous position from which it would be almost impossible to right himself.

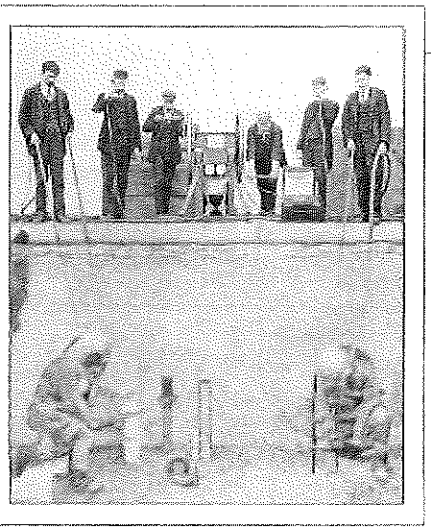
Also, while modern scuba tanks provide air pressures of 3,000 pounds per square inch (psi) or more, nineteenth-century hand-cranked pumps generated top pressures of barely 200 psi—even with no leaks and two strong men pumping full speed—and usually far less. Without today's demand regulators, which automatically adjust the air pressure with changing depth, 1880s divers had to cope constantly with too much air—blowing up their suits like balloons—or too little.

Upon reaching thirty or forty feet, Dwyer could feel the weight of the water on his body start to exceed the pressure of the air coming into his helmet. This made his suit compress around him, and each breath became a struggle. He signaled for the men to pump harder, which would solve the problem until he descended a bit farther and the pressure became unbalanced again. Then he would have to signal yet again for more pressure. By the time he reached ninety or one hundred feet the airflow remained anemic no matter how hard the men on the surface worked their pump.

Divers in the 1880s knew about the crippling effects of caisson disease—"the bends." They had seen the bends paralyze and kill men working in pressurized chambers laying the foundation for the Brooklyn Bridge, among other places. Divers knew that briefer stays underwater and slower ascents decreased the danger. Paul Bert, a French scientist, had already theorized in 1878 that the problem

involved compressed gases saturating body tissues. But reliable dive tables and firm diagnosis of decompression sickness would not be available for another thirty years. Dwyer knew he had to limit his dive on the *Oregon* to twenty minutes to be safe, but he could not say exactly why.

The cargo Dwyer was salvaging that day consisted of wooden crates from the ship's hold containing valuable items, including personal effects of the passengers. Insurance companies would pay Dwyer to salvage them. To raise the crates, Dwyer would take one at a time, secure it to a lift line from above, signal the ship, and then get himself out of the way. Steam-powered shipboard engines would do the hoisting. (Steam power was not used to pump air because its speed could not be controlled easily.)



A 1913 demonstration of diving procedures includes telephones among the equipment.

When he reached the *Oregon*'s deck, Dwyer's first problem was to find his way around. He had memorized the ship's layout, but no reliable underwater electric lamps or flares existed yet. He could see only by the dim natural light as he looked out through his helmet's three glass windows. When walking about the ship, even with weighted boots, Dwyer had to lean far forward against the water to move ahead. In opposing currents, he had to pull himself along a wall or rail. Inside the interior rooms and cargo holds, he groped in near-total darkness, navigating by touch while crawling on his hands and knees, hoping not to foul his lines.

Dwyer reached the cargo area and located the wooden crates. Working quickly, he fastened several of them to lift lines, and each in turn was pulled up through an overhead hatch. The physical labor was draining, and it was made worse by the weak airflow into his helmet. Then, as now, the combination of cold, dark, fatigue, limited dexterity, and awkward gear was a sure recipe for trouble.

Dwyer kept to his job. He connected a line from the ship to yet another of the large cargo crates and signaled for the hoist. But as the crate began to rise, Dwyer noticed his own lines rising too. Looking up, he saw that his air hose and lifeline were fouled, wrapped around an overhead metal beam that was tangled in the lift line connected to the crate. They all were being dragged upward.

As the lines pulled tight, they started dragging Dwyer as well. He dared not resist. He allowed his body to be pulled loosely along, hoping to avoid damaging his gear.

Seconds later his air hose snapped. His lifeline remained stuck, tangled in the metal beam.

As the broken air hose dangled just four or five feet above his head, Dwyer jumped to grab it but could barely lift his weighted shoes from the ship's deck.

It is hard to imagine just how mortal Bill Dwyer must have felt at that moment, standing at the bottom of the ocean, alone with the fishes. With his lifeline snagged, he could not signal above for help. With his air hose cut, he would suffocate in minutes. In addition, while diving helmets by the 1880s had safety valves to keep them from filling with water if the air hose leaked or disconnected, the system was not perfectly sealed. Dwyer knew that the pressure inside his helmet would diminish as the remaining air leaked out. He would slowly be crushed as the growing relative weight of water on his body tried to press him into the relative vacuum inside the helmet. Blood would rush to his head at increasing pressure until it killed him.

What to do?

An emergency out-of-air ascent? This procedure, taught today to every novice scuba diver as part of qualifying for a basic certification, simply would not have worked with 1880s gear. On a shallower dive, with his air hose still connected, Dwyer could have dropped his chest and back weights, cut his lifeline, let air fill his suit, and floated to the surface—a slow, awkward process, but possible. But at one hundred feet with air cut off, there was no way.

Sharing air with another diver? Even if there had been one, and if Dwyer could have reached him, there was no way to pass air hoses between helmets. Dwyer could do little but wait, try to keep his wits, and hope for help from his crew on the surface. Dive operations in the 1880s had strict rules for surface crews while divers were down. The tender had to concentrate fully on the lines to sense any signal from below. No horseplay was allowed.

Bill Dwyer's tender, standing on the boat above, must have noticed something odd about the latest piece of cargo. He saw a rush of bubbles hit the surface, maybe from a hose break or maybe just from Dwyer's adjusting his helmet. The lifeline suddenly became taut. Still, a good tender did not pull a diver up prematurely but waited for a signal.

When the cargo reached the surface, revealing the ruptured air hose, there was no longer any doubt. Dwyer's tender reacted instantly. He called for help. In a flash everyone on board grabbed the lifeline and began hoisting.

Bill Dwyer was lucky. If his lifeline had been cut too, he would have been marooned, with no way to pull him up besides sending another diver down. By then he would have suffocated. In this case, after a short struggle, the lifeline broke free of the beam it was tangled in, and the crew began pulling it in yard by yard.

Dwyer, at the bottom, felt a sudden, violent tug around

his waist. Rising through the water toward daylight, gasping at the stale air inside his helmet, he felt the pressure on his body and inside his head start to ease. His every instinct may have screamed to kick and fight toward the surface and fresh air, but Dwyer had no power over the situation. He could rise no faster than his crew could pull him up.

Finally his helmet broke water. His mates quickly reached over the side of the boat, grabbed him, and pulled him in. First thing, his tender unscrewed the glass window over Dwyer's face to let fresh air in. Dwyer took several deep, hungry breaths. His face must have been an ugly sight, the pressure inside his head causing bloodshot eyes, bloody nose, and ruddy cheeks. But the worse dangers were more subtle; caisson disease and embolism.

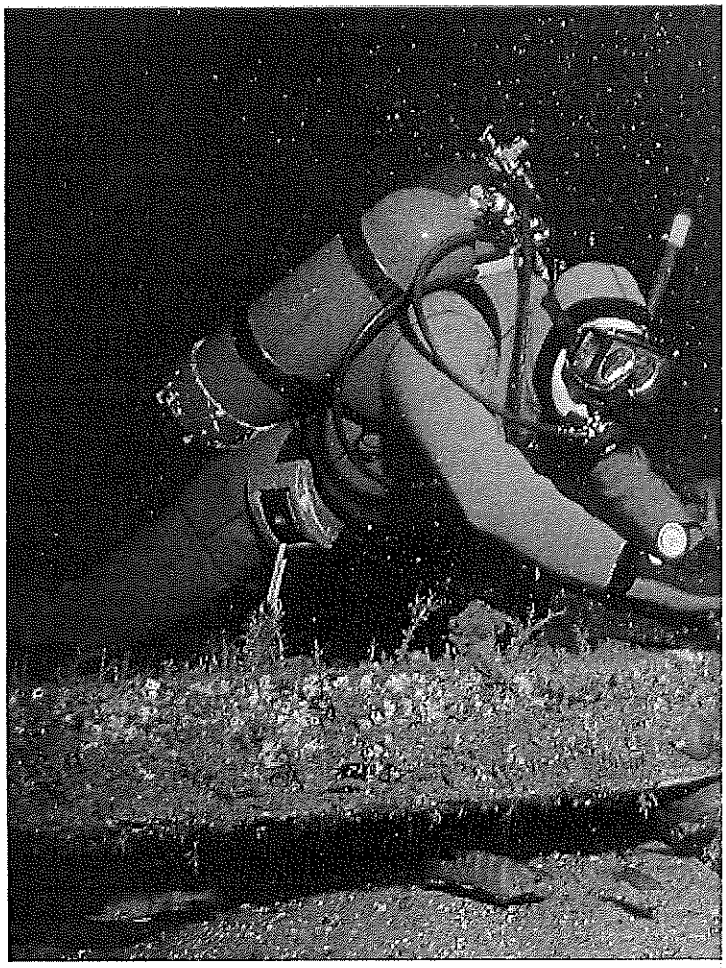
Not fully understanding what caused the bends, dive crews in the 1880s could only guess at the right treatment. High-pressure chambers existed to keep underwater tunnel workers from getting the bends, but they were not used for divers until much later. Instead, the favored cure was to throw the diver immediately into a tub of very hot water. This was unfortunate, since heat makes gases come out of solution, heightening, not lessening, the risk of the bends. If pain began, they would put the diver into a tub of ice. All told, it sounded more like torture than treatment.

Bill Dwyer suffered no embolism from his ascent that day, no bends, and no serious burns from his hot bath. His face healed slowly. But the trauma of near death did not end his salvage career. Dwyer continued work on the *Oregon* and became a well-known figure in nineteenth-century diving. In 1898, when the U.S. battleship *Maine* sank from an explosion in Havana Harbor, Dwyer was one of a handful of divers hired by the U.S. Navy to examine the wreck to determine whether the Spanish had sunk her.

Despite the dangers dramatized by experiences like that of Bill Dwyer, hard-hat diving flourished. Beyond traditional shipping, construction, and military work, a new profession, treasure hunting, emerged as freelance boat captains began scouring the floors of the seven seas for lost gold or cargo from centuries of previously unreachable shipwrecks. A few hardy souls even plunged the depths simply for the pleasure of experiencing the underwater realm.

The need for divers to go deeper, stay longer, and work better below pressed technology forward. Within a decade after Bill Dwyer's incident on the *Oregon*, new helmets came on the market equipped with telephones so divers could speak directly to their tenders on the surface. Electric underwater lights soon eliminated the dangers of groping in the darkness. In 1898 Louis Boutan, a French zoologist, published the first underwater photographs—murky black-and-white images of seaweed and rocks.

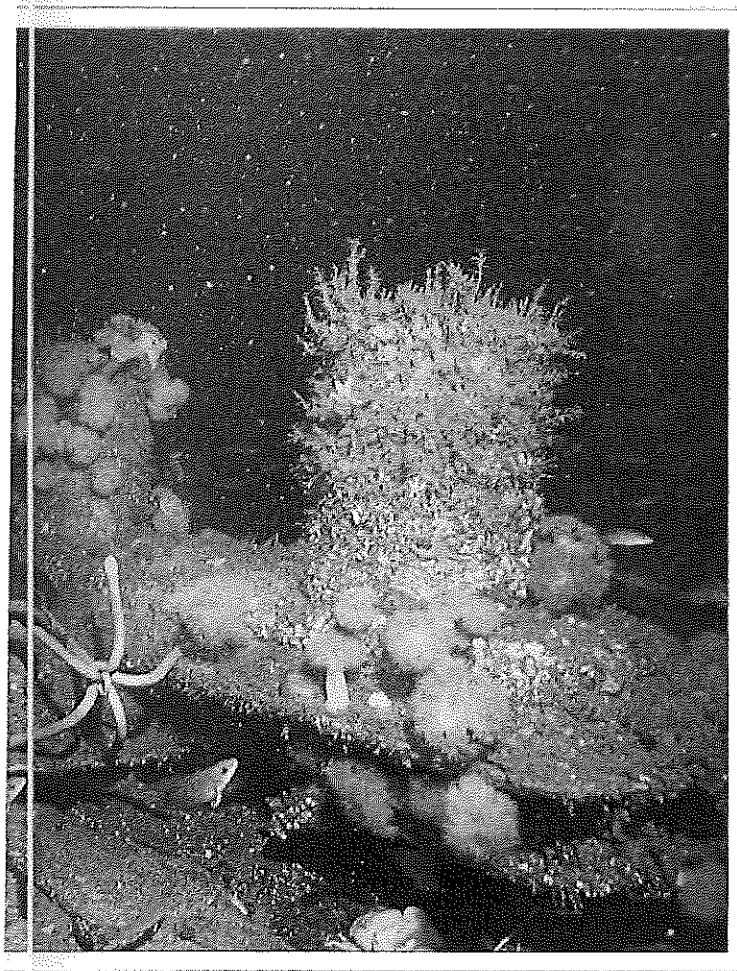
Even the dreaded "bends" retreated before science. Dr. John Scott Haldane led a 1907 British Admiralty commission in developing the first tables telling divers how to explore



A modern diver at the *Oregon* wreck wears a neoprene rubber suit and breathe

depths of up to 210 feet without risking having nitrogen bubbles form in their bodies upon ascent. The secret? Limiting dive times and making staged intermediate stops en route to the surface. Decompression chambers soon allowed divers with bends symptoms to be artificially returned to high-pressure conditions, forcing nitrogen bubbles back into solution. The pressure could then be decreased slowly as the diver sat in a warm, dry cocoon. Decompression sickness remains a danger even today, but with tables and computer programs based on Haldane's work, the biggest cause of bends today is diver error.

The biggest danger facing Bill Dwyer's generation of divers, though, could not be solved without cutting the umbilical cord to the surface and allowing men to swim free and unfettered like the fish around them. The idea for modern scuba, in which divers carry air in portable high-pressure cylinders accessed through demand mouthpieces or regulators, is hardly new. Two Frenchmen in the 1860s built a primitive scuba-like system, which Jules Verne upgraded and supplied to Captain Nemo for his exploits abroad the *Nautilus* in *Twenty Thousand Leagues Under the Sea*. But the best high-pressure tanks at the time held only about 700 psi of air—barely enough for a few minutes of breathing at



is air from tanks on his back. The lead-weighted belt survives from Dwyer's day.

depth. This made the idea impractical.

By the 1890s Siebe, Gorman & Company—the firm founded by Augustus Siebe—produced its own self-contained hard-hat "dress" for commercial divers. It was designed to resemble what Bill Dwyer had worn on the *Oregon*—copper helmet, weighted boots, rubber suit—but it had one key difference. Instead of a hose attached to an air pump on the surface, the diver carried a backpack with three small metal tanks. One of these held alkaline filters to remove carbon dioxide from exhaled air; the other two contained oxygen-enriched air. As the diver breathed underwater, the system recycled his breath, freshened with air from the tanks (which also counteracted the water pressure on the outside of the suit).

Divers hated these contraptions and wore them only for onerous jobs like penetrating flooded caves or tunnels. The air tasted stale and became unbreathable after barely an hour. At depths of just fifty feet, the small air/oxygen tanks became useless for equalizing pressures; divers also risked the convulsions and blackouts caused by oxygen toxicity.

Worst of all, they hated the isolation. Walking the sea floor in these heavy, weighted suits, divers had no tie to the surface—no lifeline to signal to a tender above, no way for friends and mates to react in a crisis. Instead of the familiar "pah . . . pah . . . pah" of the air pump, they heard only the sound of their own bubbles.

The real breakthrough came in 1943, when Jacques Cousteau, then a young French naval officer, and Emile Gagnan, an industrial engineer, fitted a high-pressure air tank with a demand regulator, which allowed the diver to breathe at will from a machine strapped to his back—the aqualung.

By the 1940s high-pressure cylinders could store air at well above 2,250 psi. Demand regulators designed for gas-powered engines were easily adapted to supplying a human breath. Cousteau's aqualung freed divers not only from their air link to the surface but also from the weighted shoes, bulky helmets, and clumsy outfits that made them immobile under the sea.

Commercial divers still use hard-hat gear for special conditions, such as ultradeep descents, when they need to communicate with the surface, breathe special mixtures of gases, or carry special equipment hookups. With the aqualung and modern scuba, any reasonably fit person can share the adventure and beauty of the underwater world. Recreational divers today number in the millions worldwide. Diving resorts dot the Caribbean and tropical seas; charter boats carry thousands of enthusiasts every day to dive spots in coastal waters from California to Florida to North Carolina to New Jersey. Every year diving accidents become rarer.

But the nineteenth-century diving pioneers left a special legacy of adventure and courage that still flavors the sport of underwater exploration. The story of Bill Dwyer's narrow escape from the *Oregon* became legend among the wharves and alleys of the New York waterfront. Today, more than a hundred years later, any certified sport diver can travel back over this historical road and dive the wreck of the *Oregon* from any number of charter boats. Modern divers find it a prime hunting ground for lobsters and artifacts.

The biggest surprise on diving the *Oregon* today is not the ease or convenience of making the descent with modern gear. In fact, even using the best up-to-date equipment—high-quality wet or dry suits, dive computers, "pony bottles," or double tanks—the *Oregon* is still a demanding dive recommended for experienced divers. Tackling its hundred-plus-foot depths, limited visibility, cold water, and often rough seas requires careful planning and physical stamina, making it a satisfying challenge.

Rather, the surprise is that Bill Dwyer and his mates were able to make the dive at all with the hand-cranked pumps, rubber hoses, and copper helmets of their day. What the divers of a century ago lacked in knowledge and equipment, they made up in guts. ★

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